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# Science and Man . . .

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## *Meeting Nutritional Needs*

A LARGE PART of the world's agricultural economy must be devoted to practical solutions to the problem of diets that are deficient in amino acids. How can we enable every person to consume about two pounds a year of some special nutrients not readily available in existing diets?

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If it were enough to manufacture these essential amino acids, I have no doubt that industrial synthesis would be the preferred route. But they must also be distributed, paid for and consumed. These requirements make indigenous agriculture the closest short-range solution.

Meeting immediate nutritional needs is avalogous to meeting problems of public health. The existing human emergency must be met even if it means creating eventual secondary problems that may become even more grievous. Thus the reduction of child mortality bequeathed us the population explosion. Similarly, expansion of world agriculture to meet contemporary needs may delay equally important industrial development and plant the seeds for a pernicious form of technological unemployment.

Agricultural self-sufficiency is essential to a developing country. A country that cannot produce enough food must divert its other production, potential capital savings, to survive. In underdeveloped countries, agriculture is the most competitive, rapidly expandable form of production. The markets are built in, as are the major resources of land, sunlight, sometimes water and always an excess of labor.

It is unrealistic for any country to skip over the stage of agricultural sufficiency as part of its development, unless it starts out blessed with unusual capital resources like petroleum or a pre-educated immigrant population.

THE PLANNING for long-range development must, however, take account of some likely technological innovations. The peril is that both the scope and quality of agricultural investment may become suddenly obsolete in the future.

The worst hazard is insufficient education. Then a country's agriculture may become too specialized and be displaced by synthetic or competing agricultural products, as happened with rubber in Malaysia and butterfat in Wisconsin.

We may hope, rather than fear, that industrial synthesis of amino acids will alleviate a general shortage of these substances from crops. But such developments are bound to have a disturbing economic impact on markets for new foodstuffs in coming years. It is crucial to rational planning, therefore, that we have a clear outlook on such expectations.

Much discussion of world agriculture focuses on the next 20 years. On one hand, it seems barely possible to keep up with the expected population growth over that interval. On the other, that is quite a long time for scientific innovation; unfortunately it is hard to rely on specific expectations in making important policies.

Essential amino acid (animal protein) requirements can be formulated as a biological problem, a genetic deficiency blocking internal synthesis of these compounds. It may then have a biological solution: the *reimplantation of the requisite genes* to rebuild the biosynthetic capacity of the human.

Analogous experiments have been done with bacteria, using bacterial viruses to transfer the new genes. It will be surprising if similar augmentation of the human genotype cannot be accomplished within the next few years.

From this standpoint, amino acid deficiency is a genetic disease that we now treat by dietary replacement. An alternative solution would be a vaccine-like inoculation to take the place of the genes that normal men never had.

Such proposals have until now been directed at repairing rare genetic metabolic defects like phenylketonuria. They may be even more cogent for some of the most prevalent disorders of contemporary man.